

CLAIMS

1. A communication method for a carrier-sense-multiple-access (CSMA) network including a radio terminal and a base station to which the radio terminal belongs, the communication method supporting request-to-send/clear-to-send (RTS/CTS) to prevent a collision of packets due to a hidden terminal, the communication method comprising:

RTS-transmitting including the base station transmitting a request-to-send (RTS) frame to the radio terminal during a transmission-suspend-period in which the radio terminal suspends transmission to prevent the collision of packets;

RTR-transmitting including the radio terminal transmitting a request-to-receive (RTR) frame to the base station after the transmission-suspend-period has elapsed; and

data-transmitting including the base station transmitting a data frame to the radio terminal in response to the RTR frame.

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2. The communication method according to claim 1, further comprising storing including the base station temporarily storing the data frame to be transmitted to the radio terminal.

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3. The communication method according to claim 2, wherein the storing includes the base station storing the data frame after the base station transmits the RTS frame to the radio terminal for a predetermined number of times.

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4. The communication method according to claim 1, wherein when the base station does not receive a clear-to-send (CTS) frame from the radio terminal due to a suspension of

the transmission, and when there is another data frame to be transmitted to another radio terminal, the base station performs a communication with the another radio terminal in priority to a communication with the radio terminal, and

5 the radio terminal extends the transmission-suspend-period based on a usage period for which the another radio terminal uses a channel.

5. The communication method according to claim 1, wherein
10 when a plurality of base stations or a plurality of other radio terminals transmit a plurality of RTS frames, respectively, to the radio terminal during the transmission-suspend-period, the RTR-transmitting includes the radio terminal transmitting the RTR frame to the base
15 stations or to the other radio terminals sequentially in descending order of priority.

6. A communication method for a carrier-sense-multiple-access (CSMA) network including a radio terminal and a
20 plurality of base stations, at least one of the base stations supporting request-to-send/clear-to-send (RTS/CTS) to prevent a collision of packets due to a hidden terminal, at least another one of the base stations not supporting RTS/CTS, the communication method comprising:

25 data-transmitting including a base station to which the radio terminal belongs transmitting a data frame to the radio terminal during a transmission-suspended-period in which the radio terminal suspends transmission to prevent the collision of packets;

30 RTR-transmitting including the radio terminal transmitting a request-to-receive (RTR) frame to the base station after the transmission-suspend-period has elapsed; and

data-retransmitting including the base station retransmitting the data frame to the radio terminal in response to the RTR frame.

5 7. The communication method according to claim 6, further comprising storing including the base station temporarily storing the data frame to be retransmitted to the radio terminal.

10 8. The communication method according to claim 7, wherein the storing includes the base station storing the data frame after the base station transmits the data frame to the radio terminal for a predetermined number of times.

15 9. The communication method according to claim 6, wherein when the base station does not receive an acknowledgement (ACK) frame from the radio terminal due to a suspension of the transmission, and when there is another data frame to be transmitted to another radio terminal, the
20 base station performs a communication with the another radio terminal in priority to a communication with the radio terminal, and

the radio terminal extends the transmission-suspend-period based on a usage period for which the another radio
25 terminal uses a channel.

10. The communication method according to claim 6, wherein when a plurality of base stations or a plurality of other radio terminals transmit a plurality of data frames,
30 respectively, to the radio terminal during the transmission-suspend-period, the RTR-transmitting includes the radio terminal transmitting the RTR frame to the base stations or to the other radio terminals sequentially in

descending order of priority.

11. The communication method according to claim 1, wherein the data-retransmitting includes

5 the base station transmitting a request-to-send (RTS) frame to the radio terminal in response to the RTR frame;
 the radio terminal transmitting a clear-to-send (CTS) frame to the base station in response to the RTS frame;
 the base station retransmitting the data frame to the
10 radio terminal in response to the CTS frame; and
 the radio terminal transmitting an acknowledgement (ACK) frame after having received the data frame.

12. The communication method according to claim 1, wherein
15 the data-retransmitting includes

 the base station transmitting the data frame to the radio terminal in response to the RTR frame; and
 the radio terminal transmitting an acknowledgement (ACK) frame after having received the data frame.

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13. The communication method according to claim 6, wherein the data-retransmitting includes

 the base station transmitting the data frame to the radio terminal in response to the RTR frame; and
25 the radio terminal transmitting an acknowledgement (ACK) frame after having received the data frame.

14. The communication method according to claim 11, wherein another radio terminal, which receives the RTR
30 frame from the radio terminal or communicates with the base station that has received the RTR frame from the radio terminal, suspends transmission to prevent the collision of packets until the data-retransmitting is completed.

15. The communication method according to claim 12,
wherein another radio terminal, which receives the RTR
frame from the radio terminal or communicates with the base
5 station that has received the RTR frame from the radio
terminal, suspends transmission to prevent the collision of
packets until the data-retransmitting is completed.

16. The communication method according to claim 13,
10 wherein another radio terminal, which receives the RTR
frame from the radio terminal or communicates with the base
station that has received the RTR frame from the radio
terminal, suspends transmission to prevent the collision of
packets until the data-retransmitting is completed.

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17. A radio terminal employing carrier-sense-multiple-
access (CSMA) with request-to-send/clear-to-send (RTS/CTS)
to prevent a collision of packets due to a hidden terminal,
the radio terminal comprising:

20 an RTS-receiving unit that receives a request-to-send
(RTS) frame from a base station, to which the radio
terminal belongs, during a transmission-suspend-period in
which the radio terminal suspends transmission to prevent
the collision of the packets; and

25 an RTR-transmitting unit that transmits a request-to-
receive (RTR) frame to the base station after the
transmission-suspend-period has elapsed.

18. The radio terminal according to claim 17, wherein when
30 the RTS-receiving unit receives a plurality of RTS frames
from a plurality of base stations or from a plurality of
other radio terminals during the transmission-suspend-
period, the RTR-transmitting unit transmits the RTR frame

to the base stations or to the other radio terminals sequentially in descending order of priority.

19. The radio terminal according to claim 17, further
5 comprising an extending unit that extends, when the base station performs a communication with another radio terminal in priority to a communication with the radio terminal during the transmission-suspend-period, the
10 transmission-suspend-period, based on a usage period for which the another radio terminal uses a channel.

20. A radio terminal that employs carrier-sense-multiple-access (CSMA) and belongs to a base station not supporting request-to-send/clear-to-send (RTS/CTS), the radio terminal
15 comprising:

a data-receiving unit that receives a data frame from the base station during a transmission-suspend-period in which the radio terminal suspends transmission due to another base station supporting RTS/CTS; and
20 an RTR-transmitting unit that transmits a request-to-receive (RTR) frame to the base station after the transmission-suspend-period has elapsed.

21. The radio terminal according to claim 20, wherein when
25 the data-receiving unit receives a plurality of data frames from a plurality of base stations or from a plurality of other radio terminals during the transmission-suspend-period, the RTR-transmitting unit transmits the RTR frame to the base stations or to the other radio terminals
30 sequentially in descending order of priority.

22. The radio terminal according to claim 21, further comprising an extending unit that extends, when the base

station performs a communication with another radio terminal in priority to a communication with the radio terminal during the transmission-suspend-period, the transmission-suspend-period, based on a usage period for
5 which the another radio terminal uses a channel.

23. The radio terminal according to claim 17, further comprising:

10 a CTS-transmitting unit that transmits a clear-to-send (CTS) frame to the base station in response to another RTS frame that is transmitted from the base station in response to the RTR frame; and

an ACK-transmitting unit that transmits an acknowledgement (ACK) frame to the base station after
15 having received a data frame that is transmitted from the base station in response to the CTS frame.

24. The radio terminal according to claim 17, further comprising an ACK-transmitting unit that transmits an
20 acknowledgement (ACK) frame to the base station after having received a data frame that is transmitted from the base station in response to the RTR frame.

25. The radio terminal according to claim 20, further comprising an ACK-transmitting unit that transmits an
25 acknowledgement (ACK) frame to the base station after having received a data frame that is transmitted from the base station in response to the RTR frame.

30 26. A base station employing carrier-sense-multiple-access (CSMA) with request-to-send/clear-to-send (RTS/CTS), the base station comprising:

an RTS-transmitting unit that transmits a request-to-

send (RTS) frame to a radio terminal during a transmission-suspend-period in which the radio terminal suspends transmission to prevent a collision of packets;

an RTR-receiving unit that receives a request-to-receive (RTR) frame from the radio terminal after the transmission-suspend-period has elapsed;

an RTS-retransmitting unit that retransmits the RTS frame to the radio terminal in response to the RTR frame; and

a data-transmitting unit that transmits a data frame to the radio terminal in response to a clear-to-send (CTS) frame that is transmitted from the radio terminal in response to the RTS frame retransmitted.

27. A base station employing carrier-sense-multiple-access (CSMA) with request-to-send/clear-to-send (RTS/CTS), the base station comprising:

an RTS-transmitting unit that transmits a request-to-send (RTS) frame to a radio terminal during a transmission-suspend-period in which the radio terminal suspends transmission to prevent a collision of packets;

an RTR-receiving unit that receives a request-to-receive (RTR) frame from the radio terminal after the transmission-suspend-period has elapsed; and

a data-transmitting unit that transmits a data frame to the radio terminal in response to the RTR frame.

28. The base station according to claim 26, further comprising a buffer that temporarily stores the data frame to be transmitted to the radio terminal.

29. The base station according to claim 27, further comprising a buffer that temporarily stores the data frame

to be transmitted to the radio terminal.

30. The base station according to claim 28, wherein the buffer stores the data frame after the RTS-transmitting
5 unit transmits the RTS frame to the radio terminal for a predetermined number of times.

31. The base station according to claim 29, wherein the buffer stores the data frame after the RTS-transmitting
10 unit transmits the RTS frame to the radio terminal for a predetermined number of times.

32. The base station according to claim 26, wherein when the CTS frame is not transmitted from the radio terminal in
15 response to the RTS frame transmitted due to a suspension of the transmission, and when there is another data frame to be transmitted to another radio terminal, the base station performs a communication with the another radio
terminal in priority to a communication with the radio
20 terminal.

33. The base station according to claim 27, wherein when a clear-to-send (CTS) frame is not transmitted from the radio terminal in response to the RTS frame transmitted due to a
25 suspension of the transmission, and when there is another data frame to be transmitted to another radio terminal, the base station performs a communication with the another radio terminal in priority to a communication with the radio terminal.

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34. A base station employing carrier-sense-multiple-access (CSMA) without request-to-send/clear-to-send (RTS/CTS), the base station comprising:

a data-transmitting unit that transmits a data frame to a radio terminal during a transmission-suspend-period in which the radio terminal suspends transmission due to another base station supporting RTS/CTS;

5 an RTR-receiving unit that receives a request-to-receive (RTR) frame from the radio terminal after the transmission-suspend-period has elapsed; and

a data-retransmitting unit that retransmits the data frame to the radio terminal in response to the RTR frame.

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35. The base station according to claim 34, further comprising a buffer that temporarily stores the data frame to be retransmitted to the radio terminal.

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36. The base station according to claim 35, wherein the data-transmitting unit transmits the data frame to the radio terminal repeatedly until an acknowledgement (ACK) frame is transmitted from the radio terminal in response to the data frame transmitted, and

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the buffer stores the data frame after the data-transmitting unit has transmitted the data frame for a predetermined number of times.

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37. The base station according to claim 34, wherein when an acknowledgement (ACK) frame is not transmitted from the radio terminal in response to the data frame transmitted due to a suspension of the transmission, and when there is another data frame to be transmitted to another radio terminal, the base station performs a communication with the another radio terminal in priority to a communication with the radio terminal.

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38. A communication method for a carrier-sense-multiple-

access (CSMA) network including a radio terminal and a base station to which the radio terminal belongs, the communication method supporting request-to-send/clear-to-send (RTS/CTS) to prevent a collision of packets due to a
5 hidden terminal, the communication method comprising:

RTS-transmitting including the radio terminal transmitting a request-to-send (RTS) frame to the base station during a transmission-suspend-period in which the base station suspends transmission to prevent the collision
10 of packets or due to an interference;

RTR-transmitting including the base station transmitting a request-to-receive (RTR) frame to the radio terminal after the transmission-suspend-period has elapsed; and

15 data-transmitting including the radio terminal transmitting a data frame to the base station in response to the RTR frame.

39. The communication method according to claim 38,
20 further comprising storing including the radio terminal temporarily storing the data frame to be transmitted to the base station.

40. The communication method according to claim 39,
25 wherein the storing includes the radio terminal storing the data frame after the radio terminal transmits the RTS frame to the base station for a predetermined number of times.

41. The communication method according to claim 38,
30 wherein

when the radio terminal does not receive a clear-to-send (CTS) frame from the base station due to a suspension of the transmission, and when there is another data frame

to be transmitted to another base station or to another radio terminal, the radio terminal performs a communication with the another base station or with the another radio terminal in priority to a communication with the base station, and

the base station extends the transmission-suspend-period based on a usage period for which the another base station or the another radio terminal uses a channel.

42. The communication method according to claim 38, wherein when a plurality of other base stations or a plurality of radio terminals transmit a plurality of RTS frames, respectively, to the base station during the transmission-suspend-period, the RTR-transmitting includes the base station transmitting the RTR frame to the other base stations or to the radio terminals sequentially in descending order of priority.

43. A base station employing carrier-sense-multiple-access (CSMA) with request-to-send/clear-to-send (RTS/CTS) to prevent a collision of packets due to a hidden terminal, the base station comprising:

an RTS-receiving unit that receives a request-to-send (RTS) frame from a radio terminal belonging to the base station during a transmission-suspend-period in which the base station suspends transmission to prevent the collision of the packets or due to an interference; and

an RTR-transmitting unit that transmits a request-to-receive (RTR) frame to the radio terminal after the transmission-suspend-period has elapsed.

44. The base station according to claim 43, wherein when the RTS-receiving unit receives a plurality of RTS frames

from a plurality of other base stations or from a plurality of radio terminals during the transmission-suspend-period, the RTR-transmitting unit transmits the RTR frame to the other base stations or to the radio terminals sequentially
5 in descending order of priority.

45. A communication method for a carrier-sense-multiple-access (CSMA) network including a radio terminal and a plurality of base stations, at least one of the base
10 stations supporting request-to-send/clear-to-send (RTS/CTS) to prevent a collision of packets due to a hidden terminal, at least another one of the base stations not supporting RTS/CTS, the communication method comprising:

data-transmitting including the radio terminal
15 transmitting a data frame to a base station to which the radio terminal belongs during a transmission-suspended-period in which the base station suspends transmission to prevent the collision of packets or due to an interference;

RTR-transmitting including the base station
20 transmitting a request-to-receive (RTR) frame to the radio terminal after the transmission-suspend-period has elapsed; and

data-retransmitting including the radio terminal retransmitting the data frame to the base station in
25 response to the RTR frame.

46. The communication method according to claim 45, further comprising storing including the radio terminal temporarily storing the data frame to be retransmitted to
30 the base station.

47. The communication method according to claim 46, wherein the storing includes the radio terminal storing the

data frame after the radio terminal transmits the data frame to the base station for a predetermined number of times.

5 48. The communication method according to claim 45, wherein

when the radio terminal does not receive an acknowledgement (ACK) frame from the base station due to a suspension of the transmission, and when there is another
10 data frame to be transmitted to another base station or to another radio terminal, the radio terminal performs a communication with the another base station or with the another radio terminal in priority to a communication with the base station, and

15 the base station extends the transmission-suspend-period based on a usage period for which the another base station or the another radio terminal uses a channel.

49. The communication method according to claim 45,
20 wherein when a plurality of other base stations or a plurality of radio terminals transmit a plurality of data frames, respectively, to the base station during the transmission-suspend-period, the RTR-transmitting includes the base station transmitting the RTR frame to the other
25 base stations or to the radio terminals sequentially in descending order of priority.

50. A base station employing carrier-sense-multiple-access (CSMA) without request-to-send/clear-to-send (RTS/CTS), the
30 base station comprising:

a data-receiving unit that receives a data frame from a radio terminal belonging to the base station during a transmission-suspend-period in which the base station

suspends transmission due to another base station or another radio terminal that support RTS/CTS; and

an RTR-transmitting unit that transmits a request-to-receive (RTR) frame to the radio terminal after the
5 transmission-suspend-period has elapsed.

51. The base station according to claim 50, wherein when the data-receiving unit receives a plurality of data frames from a plurality of other base stations or from a plurality
10 of radio terminals during the transmission-suspend-period, the RTR-transmitting unit transmits the RTR frame to the other base stations or to the radio terminals sequentially in descending order of priority.

15 52. A communication method for a carrier-sense-multiple-access (CSMA) network including a radio terminal, a first base station, and a second base station, the communication method supporting request-to-send/clear-to-send (RTS/CTS) to prevent a collision of packets due to a hidden terminal,
20 the communication method comprising:

transmitting including the second base station transmitting a frame for communication between base stations to the first base station during a transmission-suspend-period in which the first base station suspends
25 transmission to prevent the collision of packets or due to an interference;

transmitting including the first base station transmitting a request-to-receive (RTR) frame to the second base station after the transmission-suspend-period has
30 elapsed; and

transmitting including the second base station transmitting a data frame to the first base station in response to the RTR frame.

53. The communication method according to claim 52,
further comprising storing including the second base
station temporarily storing the data frame to be
5 transmitted to the first base station.

54. The communication method according to claim 53,
wherein the storing includes the second base station
storing the data frame after the second base station
10 transmits the frame for communication between base stations
to the first base station for a predetermined number of
times.

55. The communication method according to claim 52,
15 wherein

when the second base station does not receive a
response to the frame for communication between base
stations from the first base station due to a suspension of
the transmission, and when there is another data frame to
20 be transmitted to a third base station or to the radio
terminal, the second base station performs a communication
with the third base station or with the radio terminal in
priority to a communication with the first base station,
and

25 the first base station extends the transmission-
suspend-period based on a usage period for which the third
base station or the radio terminal uses a channel.

56. A base station employing carrier-sense-multiple-access
30 (CSMA) with request-to-send/clear-to-send (RTS/CTS) to
prevent a collision of packets due to a hidden terminal,
the base station comprising:

a receiving unit that receives a frame for

communication between base stations from another base station during a transmission-suspend-period in which the base station suspends transmission to prevent the collision of the packets or due to an interference; and

- 5 a transmitting unit that transmits a request-to-receive (RTR) frame to the another base station after the transmission-suspend-period has elapsed.

57. The base station according to claim 56, wherein when
10 the receiving unit receives a plurality of frames for communication between base stations from a plurality of other base stations during the transmission-suspend-period, the transmitting unit transmits the RTR frame to the other base stations sequentially in descending order of priority.